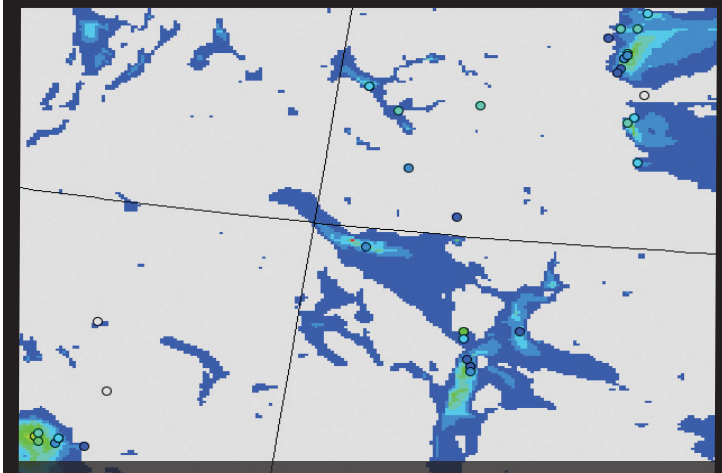
National Aeronautics and Space Administration

Tracking Public Health Impacts from Ozone and Dust in the Southwest United States

Products from the ENPHASYS project enhance New Mexico's and the Center of Disease Control and Prevention's Environmental Public Health Tracking Networks.

Aerosol concentrations from the CALIOP instrument on NASA's CALIPSO satellite offer a means of validating modeling results.



Daily average of fine particulates concentrations in the four-corners region modeled by CMAQ.

Project Goals

•Transition NASA Earth science results to useful public health products and services

•Enhance New Mexico and CDC Environmental Public Health Tracking Networks by integrating ozone and aerosol forecasts into these networks

•Model ozone events in the Southwest using EPA's Community Multiscale Air Quality model

•Produce daily forecasts of ozone, fine particulates, and aerosols for the public health community of practice

Project Outcomes

•Enhance decision-making for health through timely forecasts of air quality events

•Provide 36-48 hour forecasts of ozone, fine particulates, and aerosols via the Internet

•Make positive impact on health cost savings and improved decision-making for hospital management

•Improve clinical understanding of development of illnesses related to air quality

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Summary

The Environmental Public Health Application Systems (ENPHASYS) project bridges individual health and public health by forecasting atmospheric ozone, fine particulates (PM2.5), and other aerosols that trigger asthmatic responses or myocardial infarction (MI). Many airborne contaminants exacerbate existing health problems, increase health care costs, and reduce a person's ability to work. To identify and track incidences of environmentally caused health problems, the Center for Disease Control and Prevention (CDC) is developing the Environmental Public Health Tracking Network (EPHTN). Tracking systems built at the State level contribute data and information to this National network. The ENPHASYS project is working closely with the New Mexico Department of Health to provide ozone, PM2.5, and aerosol forecast products to the New Mexico Environmental Public Health Tracking System (EPHTS). The overarching objective is to assimilate NASA Earth science results into the Community Multiscale Air Quality Modeling System (CMAQ) and Dust REgional Atmospheric Model (DREAM) to improve these forecasts and to integrate them into EPHTS.

Societal Benefits

Important community benefits accrue from timely health alerts for ozone, fine particulate, and aerosol episodes. With adequate forewarning (36-48 hours), parents can ensure their child uses his/her medications, school children can be kept indoors at recess, hospitals can adjust staffing levels to cope with episodic increases of patient in-takes, and health services canto provide better care while optimizing operating costs. Adjusting staffing levels according to forecasts of pending episodes provides more time to correctly diagnose respiratory cases and reduces false-positive diagnoses from among several possible environmental and life style triggers. The ability to correctly apply International Classification of Diseases (ICD-9) codes for chronic respiratory and myocardial patients, and those admitted as a result of air quality episodes, will enhance longitudinal studies of asthma as a progressive disease of the lungs, and to diagnose those at risk of MI.

Project Details

The project has three primary components: 1) it improves forecasts of fine particulates by assimilating monthly masks of PM2.5 into the DREAM/eta model; 2) it incorporates MODIS Aerosol Optical Depth (AOD) and modeled fine particulates from DREAM/eta into CMAQ to estimate ozone and aerosol concentrations over the 4-corners region of Utah, Arizona, Colorado and New Mexico; and 3), it integrates the products from these data and models into the New Mexico EPHTS for analysis using an archive of health data related to ozone and aerosols.

By using monthly data for barren land distribution, it is possible to identify PM2.5 sources through change detection methods. The PM2.5 sources are derived from a 16-day NDVI land cover product combined with an improved land cover classification algorithm to inventory land patterns that alternate between cropped and barren ground. These patterns are assimilated digitally into the chosen models to produce hourly forecasts of PM2.5 and ozone concentrations. Initially, modeled outputs will be used for qualitative and quantitative comparisons with actual observed patterns to assess model improvements.

Modeling ozone and aerosol concentrations in the 4-corners region is driven by needs of the NM Department of Health. To compare initial results, CMAQ was run using three input parameters: 1) Environmental Protection Agency (EPA) concentrations that include fugitive (non-point) PM2.5; 2) EPA concentrations without fugitive PM2.5; and 3), modeled DREAM/eta PM2.5. Sources of fugitive dust include unpaved roads, agricultural cropland, and construction sites. Outputs from the CMAQ model are being verified and validated (V&V) against ground-station data and health data available from the NMDOH. Aerosol concentrations captured by the CALIOP (pronounced "calīōpē") sensor will be compared to model output and ground station data as part of the V&V process.

Working closely with public health officials, digital modeled products are ingested into EPHTS and ported to EPHTN. They are available for analysis and tracking to qualified users from both sources via web-based application services. Early results are promising.

For more information about this project

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NASA APPLIED SCIENCES PROGRAM & PUBLIC HEALTH

This application area focuses on the use of NASA assets to support planning and decision making for the public health, medical, and environmental health sectors. The application includes epidemiologic surveillance of infectious disease, environmental health, and emergency response and preparedness. Public Health also explores issues of toxic and pathogenic exposure, natural and man-made hazards for risk characterization and mitigation, and improvements to health and safety.

Key Web sites

ENPHASYS Project Homepage:
http://enphasys.unm.edu

NM EPHT Homepage:
http://nmtracking.unm.edu

CDC EPHT Homepage:
http://ephtracking.cdc.gov/showHome.action

Applied Sciences Public Health:
http://appliedsciences.nasa.gov/public-health